



SAFETY MANUAL

Ultima® OPIR-5 Infrared Open Path Gas Detector



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Safety Manual

MSA reserves the right to change published specifications and designs without prior notice.

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This manual describes the safety related information for the installation, operation, configuration, and maintenance of the Ultima OPIR-5 Open Path Gas Detector.

For complete information regarding performance, installation, operation, maintenance, and specifications of the Ultima OPIR-5 Gas Detector, please refer to the associated product manual.

MSA's mission is to benefit society by providing safety solutions through industry-leading products, services, and systems that save lives and protect capital resources from the dangers of hazardous flames, gases, and vapors.

The safety product you have purchased should be handled carefully, and installed and maintained in accordance with the Ultima OPIR-5 Gas Detector instruction manual. Remember, this product is for your safety.



WARNING: TOXIC, COMBUSTIBLE, AND FLAMMABLE GASES AND VAPORS ARE VERY DANGEROUS. USE EXTREME CAUTION WHEN THESE HAZARDS ARE PRESENT.

INTRODUCTION

General Description

The MSA Ultima OPIR-5 Gas Detector continuously monitors hydrocarbon gases and provides a 4-20 mA analog signal proportional to the LEL gas concentration and optional LEL relay output. The gas detector has Heavy Hydrocarbon (propane) version monitor gases in the 0 to 1 LEL meter range. This safety manual applies to all versions. The Ultima OPIR-5 Gas Detector uses a single beam source and detector to monitor gas concentrations, improving accuracy, reducing drift and improving immunity to false alarms. The Ultima OPIR-5 Gas Detector is regarded as a Type B field device per IEC 61508.

The safety function of the Ultima OPIR-5 Gas Detector does not include:

- HART communication
- RS-485 Modbus communication

INSTALLATION



WARNING: Under NO circumstances should equipment be connected or disconnected when under power. This is contrary to hazardous area regulations and may also lead to serious damage to the equipment. Equipment damaged in this manner is not covered under warranty.

For complete information on the installation of the Ultima OPIR-5 Gas Detector, refer to the respective product instruction manual. Be sure to closely follow alignment instructions.

Location Considerations

There are no standard rules for placement, since the optimum location varies with each application. Some factors to consider when selecting locations:

- The system should be accessible for occasional response checks. The line of sight between the Source and Receiver units should be free from objects that may block the beam and interruptions caused by frequent human or animal crossings. The Receiver unit should be mounted so that the display is visible to aid in alignment and so that direct sunlight does not enter the front window.
- Do not mount near strong magnetic fields or degradation of performance may result. Although the Ultima OPIR-5 Gas Detector is Radio Frequency Interference (RFI) resistant, it should not be mounted too close to radio transmitters or similar equipment.
- The units should be reasonably protected (i.e. covered by a hood if temperatures exceed the environmental specifications in the product instruction manual). Mount away from sources of excessive vibration and away from high voltage/high current power lines and from concentrated sources of heat.

An aperture plate is required if the open path length is less than 20 meters (Ultima OPIR-5 Gas Detector standard range).

It is important to obtain the highest alignment number possible within the allowed range.

NOTE: Frequent inspection, cleaning, and sensitivity checking is suggested for gas detectors mounted in dirty environments.

No special or additional detector mounting, wiring, power, or tool requirements exist beyond the standard installation practices documented in the Ultima OPIR-5 Gas Detector instruction manual.

OPERATION AND MAINTENANCE

For complete operation, configuration, and maintenance information for the Ultima OPIR-5 Gas Detector, refer to the product instruction manual.

Before applying power to the system for the first time, all wiring connections should be checked for correctness and the Receivers' housing cover should be securely fastened. Upon initial power-up, the Receiver will enter a two-minute set-up mode; the display will indicate "SU".

The Ultima OPIR-5 Gas Detector contains a heater circuit to remove condensation from the windows. The unit should be allowed to stabilize for approximately two hours before continuing with the setup mode.

The Ultima OPIR-5 Gas Detector is an intelligent sensor that performs internal diagnostics on critical faults every second and responds with 0 mA for an internal fault and 1.5 mA for a beam block fault (see Table 2). User selectable delays and current levels allow for system flexibility.



WARNING: The Ultima OPIR-5 Gas Detector does not respond to gas leaks upon complete IR beam blockage. Interruptions of the IR beam will delay the response time of this unit, and thus lead to a potentially unsafe situation. The optical path should be checked for blockage and the windows cleaned periodically.

The Ultima OPIR-5 Gas Detector performs accurately and reliably for propane gas detection applications in extreme industrial environments. Under the following two situations: 1) a rapid and massive liquid propane release and 2) a rapid and massive buildup of a high concentration propane gas cloud, the Ultima OPIR-5 Gas Detector recognizes both situations and forces the analog output, and optional relay output, to over-range.

Refer to the Troubleshooting Section in the Ultima OPIR-5 Gas Detector instruction manual in the event of a fault condition. In addition, spare parts should be on-hand to maintain the four hour repair time. Refer to the Spare Parts Section of the instruction manual for more information.

After the Ultima OPIR-5 Gas Detector has been initially aligned and calibrated, very little must be done to maintain the unit. Although calibration is not required, response should be tested from time to time using the Test Gas Filters designed for the detectors. MSA recommends that a maintenance schedule be established and followed. If the detector is operated under dusty or dirty conditions, the windows should be cleaned periodically. This is accomplished by gently wiping them with a soft, clean cloth, which has had a commercial window cleaning solution applied. The cleaning should be done in test mode to prevent false alarms.

SPECIFICATIONS

Table 1 and Table 2 list specifications for the Ultima OPIR-5 Gas Detector. For a complete list of specifications refer to the product instruction manual.

Ultima OPIR 5 Detector	
Instruction Manual P/N	MANOPIR5
Operating Temperature Range:	-67°F to 149°F (-55°C to 65°C)
Humidity Range:	0 to 95% RH, non-condensing
Input Voltage:	20 to 36 VDC
Supply Power Source:	With Heater – 12 Watts No Heater – 10 Watts
Supply Power Receiver:	With Relays and Heater: 10 W Relays, No Heater: 6 W No Relays, with Heater: 8.5 W No Relays, No Heater: 5 W

Table 1 – Environmental/Electrical Specifications

Mode	Ultima OPIR 5 Detector (non-HART)	Ultima OPIR 5 Detector (HART)
Fault	0 mA	1.25 or 3.5 mA
Startup	0 mA	1.25 or 3.5 mA
Set up	1.5 mA	1.5 or 3.5 mA
Gas Check	0 or 1.5 mA	1.5 or 3.5 mA
Beam Block	2 mA	2 or 3.5 mA
<u>Standard Unit</u> 0 to 5 LEL•meter	4-20 mA	4-20 mA
<u>Heavy Hydrocarbon Unit</u> 0 to 1 LEL•meter	4-20 mA	4-20 mA
Split Range	4-12 mA for 0-5000ppm•m (methane) or 0-2000 ppm•m (propane) 12-20 mA for 0-5 LEL•m (methane) or 0-1 LEL•m (propane)	4-12 mA for 0-5000ppm•m (methane) or 0-2000 ppm•m (propane) 12-20 mA for 0-5 LEL•m (methane) or 0-1 LEL•m (propane)
Over range	21.7 mA	21.7 mA

Table 2 – Analog Output Specifications (600 ohms max.)

CERTIFICATIONS AND FAILURE RATE DATA

The Ultima OPIR-5 Gas Detector has gone through rigorous reliability and functional safety assessments, which have resulted in the gas detectors as certified to IEC 61508 Parts 1, 2, and 3, by FM Approvals. The reliability assessment is a failure rate prediction that assumes an average temperature of 40°C and an environmental factor equivalent to Ground Fixed. It is assumed that the Ultima OPIR-5 Gas Detector will be installed in a Safety Instrumented System (SIS) operating in a Low Demand environment per IEC 61508. Table 3 lists the Safety Integrity Level (SIL) parameters for both systems.

Field Device	Ultima OPIR-5 Analog Output	Ultima OPIR-5 Relay Output
FM Certificate	3042476	3042476
Product Life (Years)	10 - 12*	10 - 12*
λ_{DD} (FIT)**	14.6E3	14.6E3
λ_{DU} (FIT)	102	407
Safe Failure Fraction (SFF)	>99%	97%
Safety Integrity Level (SIL)***	3	2
Diagnostic Test Interval	30 minutes for memory faults, 1 - 30 seconds for all other faults	
Response Time (when exposed to full-scale gas concentration in ppm range)	T90 ≤ 10 seconds	
Average Probability of Failure on Demand $PFD_{avg1001}$ ****	1.7E-4	5.04E-4

Table 3 – SIL Parameters for Ultima OPIR-5 Detector

* Ultima OPIR-5

Transmitter flash lamp typical life of 3 – 4 years

** FIT = Failures in 1E9 Hours

*** Hardware Fault Tolerance (HFT) = 0

**** $PFD_{avg1001}$ assumes a 4 hour repair time and 90 day proof test interval.

Ultima OPIR-5 Detector
ATEX
CSA
CE
IEC 61508 per FM Approvals
FM
IECEX
HART Communication Foundation

Table 4 – Agency Approvals



MINE SAFETY APPLIANCES COMPANY
CRANBERRY TOWNSHIP, PENNSYLVANIA, USA 16066
1-800-MSA-INST **www.msanet.com**